

Proton source

NML

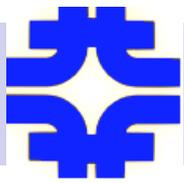
Antiproton source

CDF

Tevatron

DØ

Main Injector\ Recycler



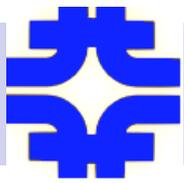
Workshop on Directions of Future Accelerator R&D at Fermilab

***“Welcome” or
“Goals of This Workshop”***

Vladimir Shiltsev

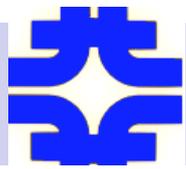
Accelerator Physics Center, FNAL

11 May 2009



Big Picture

- ❖ LHC is built and will run in 2009:
 - ▲ energy frontier moves overseas for next decade(s?)
 - ▲ confidence in getting new physics insight ~2012-13
- ❖ Growing consensus on the next machine (P5)
 - ▲ should be lepton-lepton collider
 - ▲ ILC energy reach may not be enough → multi-TeV
 - ▲ attention to alternatives (P5 report)
- ❖ Alternative schemes:
 - ▲ CLIC e+e- linear collider (CDR by ~2010)
 - ▲ plasma-wake e+e- linear colliders (emerging)
 - ▲ muon collider (aims FSDR by 2013)



Fermilab: Years Ahead

❖ Operation: *as we see them now*

▲ Run II: →2011 ν -exp: till 2013

▲ NOvA 2013-19, later, mu2e 2016-19

▲ Long-base neutrino/DUSEL 2018-202X

❖ Construction:

▲ NOvA: now-2012 mu2e: 2013-15

▲ Project X 2013-2017

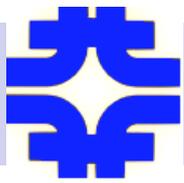
▲ Lepton collider(ILC,MC) or NF: 202X, ~5yrs

❖ R&D:

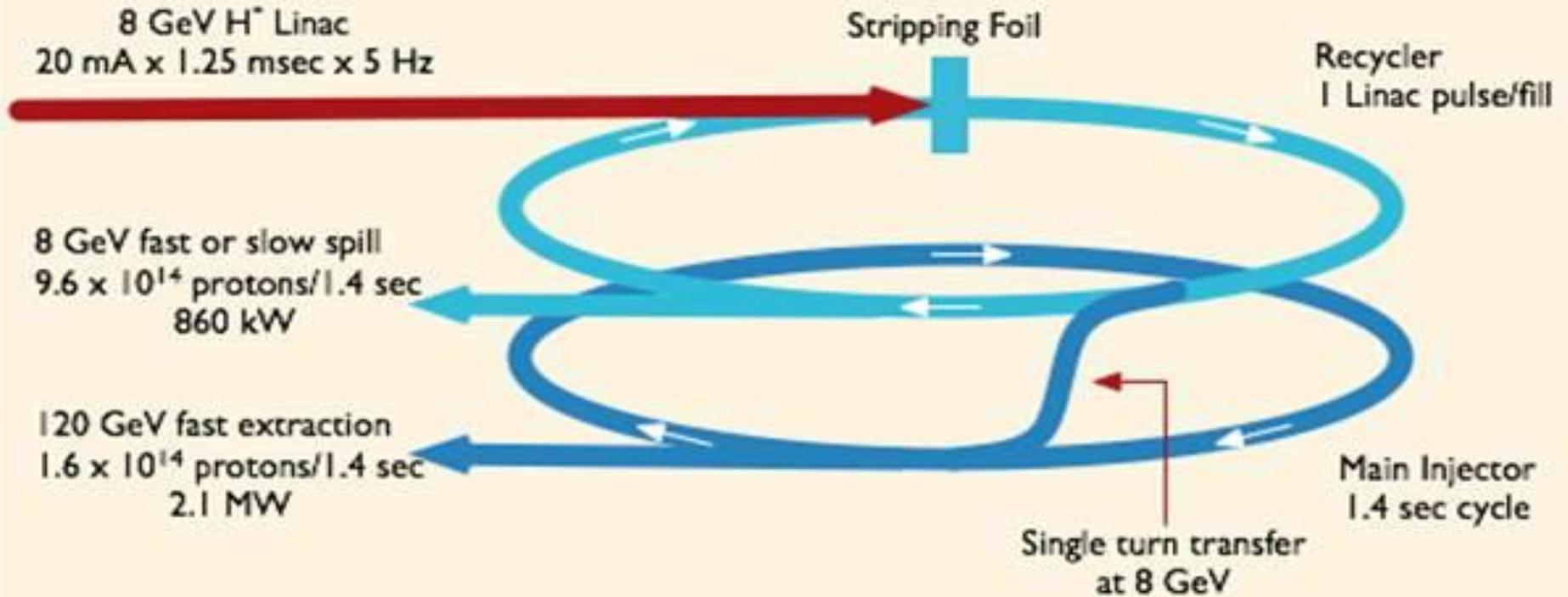
▲ SC RF and Project X: 2009-2013

▲ lepton colliders now-2013 (eg MC FSDR) → early 20's

▲ general and Advanced ARD (ongoing)

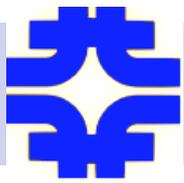


Project-X and Muon Complex



❖ Initial Configuration Document: 1 MW @ 8GeV

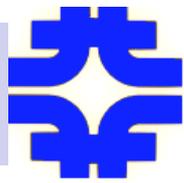
❖ MC/NF need: ~4MW@ different beam structure



Project-X Timeline

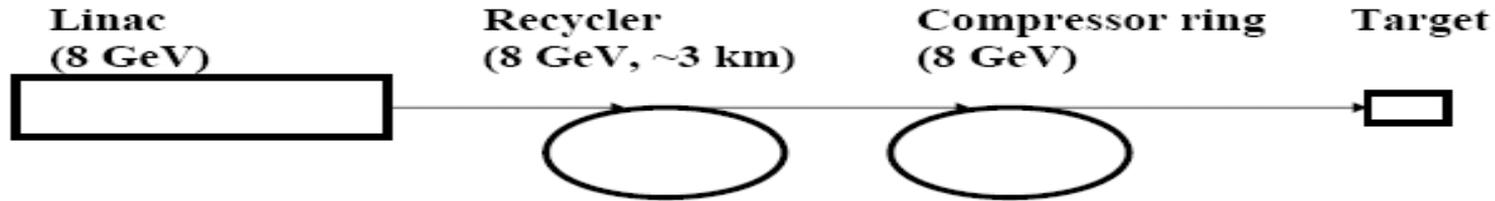
- ❖ Collaboration is being formed (08-09)
- ❖ FNAL Director's Preliminary Cost and Schedule Review (Mar'09)
- ❖ Technically limited schedule:

➤	CD-0	July 2009	}	RD&D
➤	CD-1	December 2010		
➤	CD-2	July 2012	}	PED
➤	CD-3	August 2013		
➤	CD-4	March 2018		



"Project X" : Choices and Future

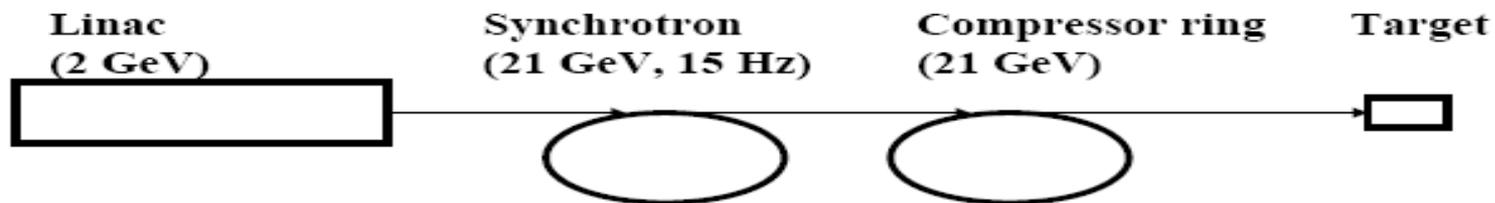
- Has to be upgradeable to NF/MC Front End (2-4 MW)
- Present Project-X with injection to Recycler + Compressor ring



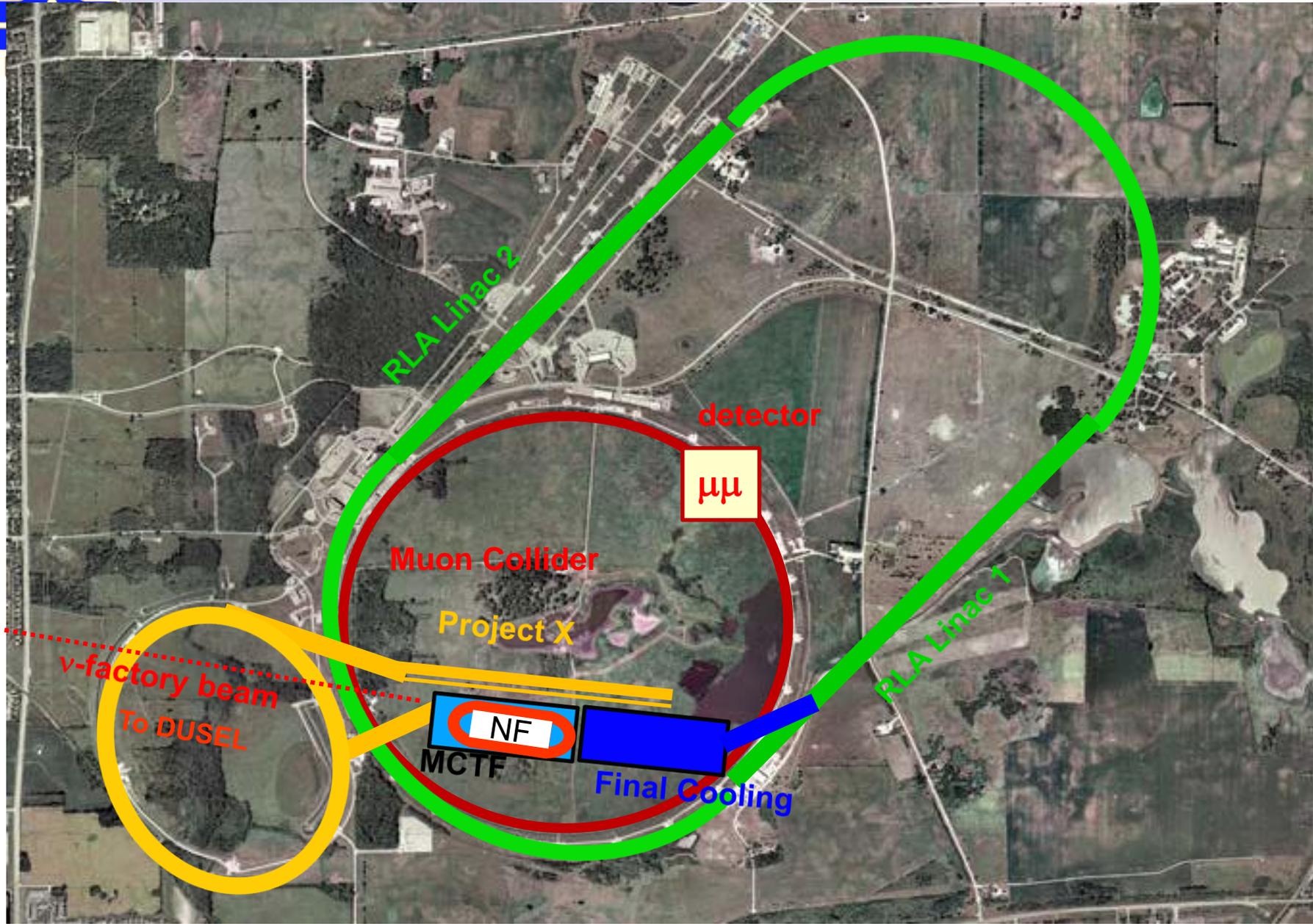
- Project-X linac + Compressor ring with direct H⁻ strip injection

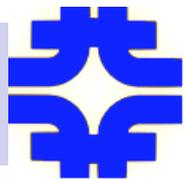


- Alternative Project-X + compressor ring

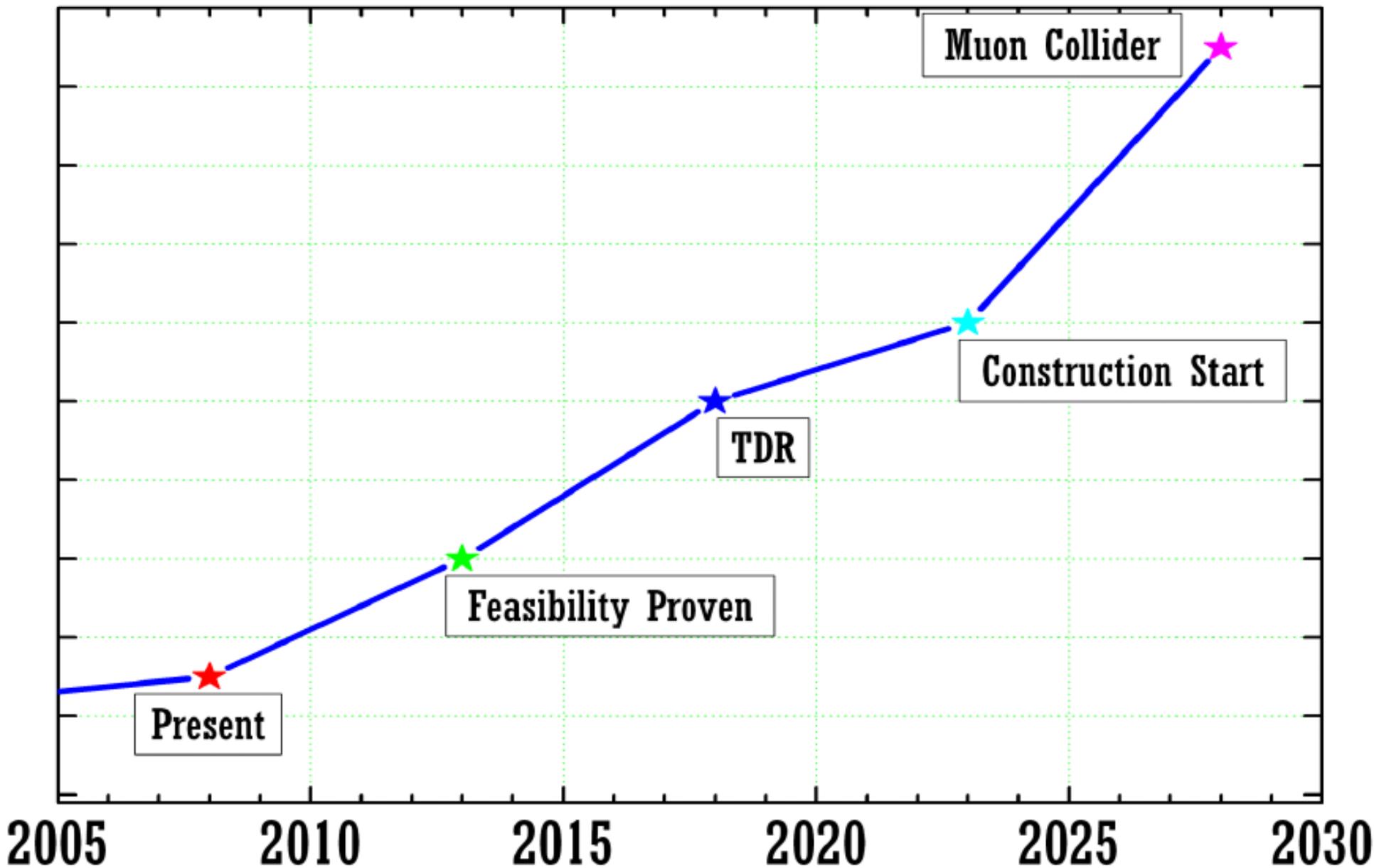


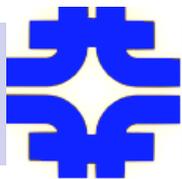
- (Under exploration) Use of SC RF Linacs for generation of ~10MW (CW?) beams for energy applications (ADS)





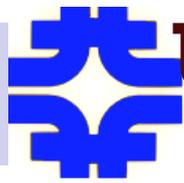
Where Do We Want to Be and When?



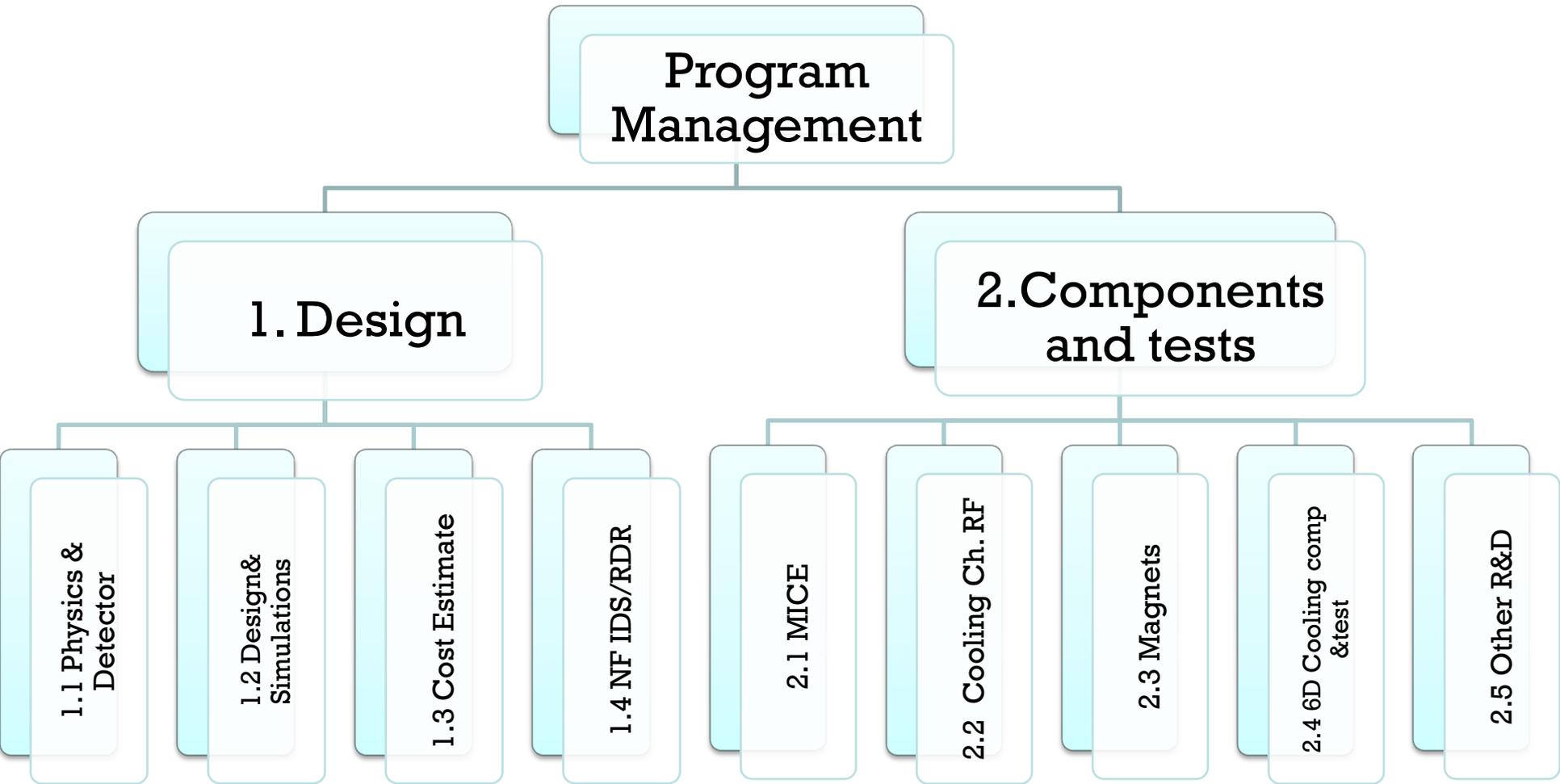


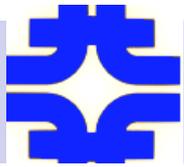
The 5 Year Plan

- ❖ **Will address key R&D issues, including**
 - ▲ Maximum RF gradients in magnetic field
 - ▲ High pressure RF tests with ionizing beam
 - ▲ 6D cooling section prototype
 - ▲ Full start-to-end simulations
 - ▲ Proton bunching ring design
 - ▲ Magnet designs for acceleration, collider and HTS
- ❖ **Deliverables by ~2013:**
 - ❖ Muon Collider Feasibility Report and ν -Factory RDR
 - ❖ Results of hardware R&D to make technology choice
 - ❖ Cost estimate
- ❖ **Funding increase needed to ~20M\$/yr (about 3x present level); total cost 90M\$**

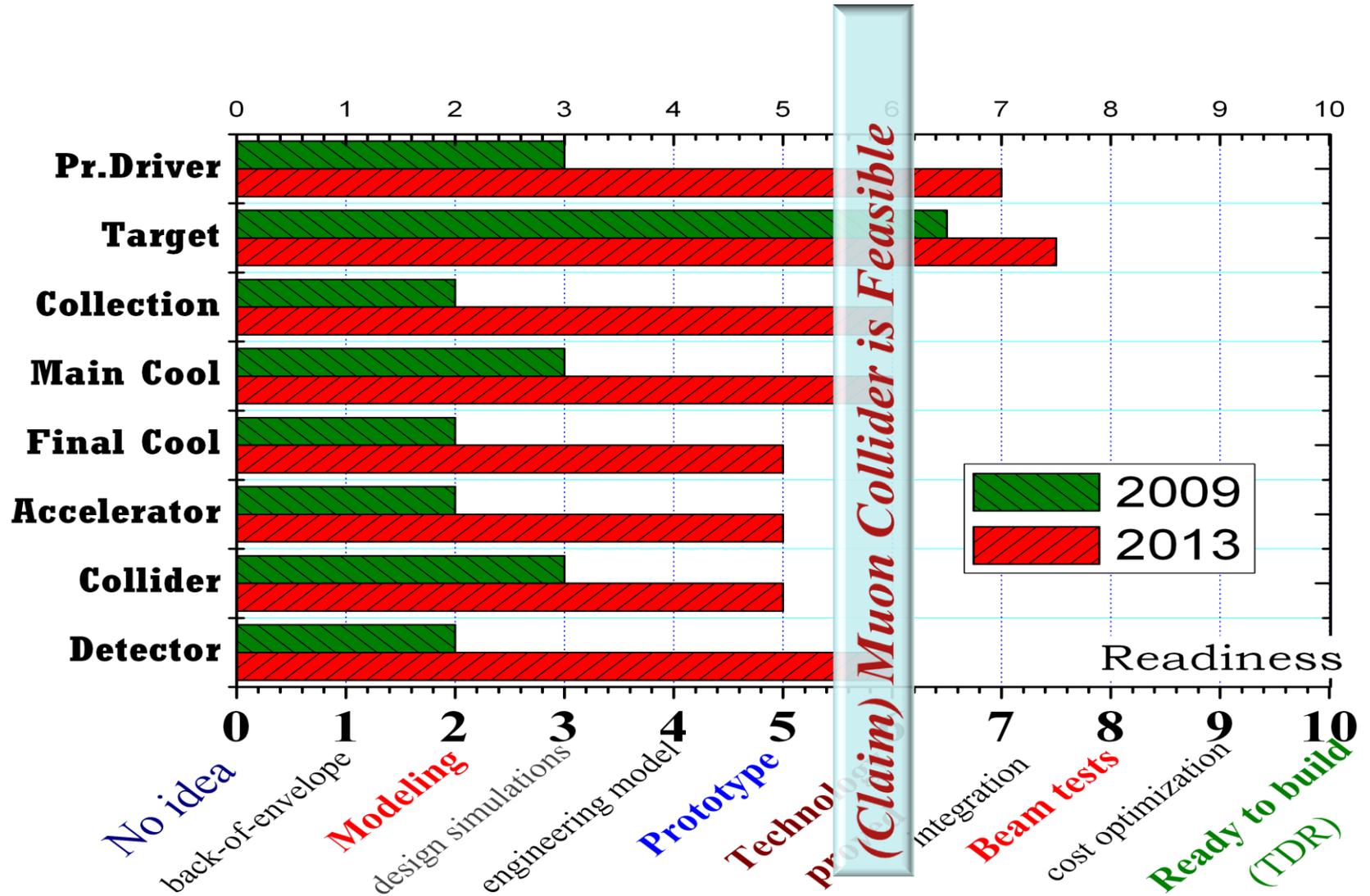


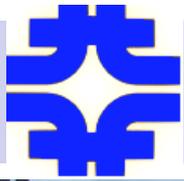
US Muon Accelerator R&D Program 5 yr plan (2009-2013)





5 yrs of Muon Collider R&D

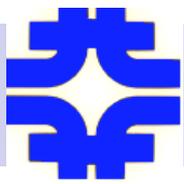




MTA=MuCool Test Area



- cryo
- RF p
- Liqu
- 5 T S
- (805
- 400M



General and Advanced ARD at FNAL

❖ Carried Out at A0 Photoinjector

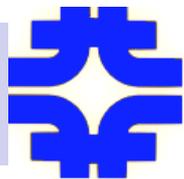
- ▲ Technology of high brightness sources
- ▲ Many expt's incl. round-to-flat transform, emittance exchange

❖ Will move out of A0 after end of Run II and expand in NML:

- ▲ More in Mike Church's talk
- ▲ Will capitalize on investment in SC RF technology and infrastructure
- ▲ planning for Users' Facility (probably hosted by FNAL, ANL and UChi) where Lab and University groups can come and do Acc.R&D
- ▲ got ARRA funds to construct NML facility extension for the Users' Facility

❖ The NML will be the largest AARD Facility in the US

- ▲ Note that smaller facilities will be possibly available , too →



So, suitable facilities/setup

❖ Running Accelerators:

▲ surely, with focus on operations, R&D possibilities will be limited

❖ NML(New Muon Lab)

❖ MDB (Meson Detector Building):

▲ HINS: 30-60MeV H- linac, Pr-X front end: cryo, RF, etc

▲ M-Test area : low rate secondary particles available

❖ Misc.:

▲ Magnet and SC RF Test facilities in TD (for hardware tests)

▲ E4R test of fast cycling magnets

▲ Unemployed e-cooling and e-lenses after end of Run II

▲ Small areas here and there...



*Support for Accelerators and for
Accelerator R&D in DOE's Office of Science*

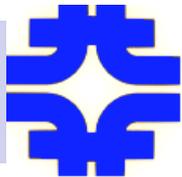
*AAAS Meeting
13 February 2009*

Patricia Dehmer

*Deputy Director for Science Programs & Acting Director
Office of Science, U.S. Department of Energy*

Workshop on ARD at FNAL

Download this talk at http://www.science.doe.gov/SC-2/Deputy_Director-speeches-presentations.htm



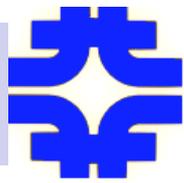
Short-term, Mid-term, and Long-term Activities

	HEP	BES	NP
Maintain and upgrade flagship user facilities	✓	✓	✓
Develop concepts, techniques, and materials for future facilities	✓	✓	✓
Maintain core competencies and a trained workforce in accelerator science	✓	✓	✓
Steward accelerator science and technology development broadly	✓		



National Accelerator Stewardship

- HEP is developing a national accelerator R&D stewardship effort
- Input will be sought via a workshop (late 2009) that examines the uses of accelerators throughout society; the desired performance characteristics of these and future accelerators; and the R&D efforts in the private and government sectors.
- The workshop will address:
 - current state of the art and practice;
 - accelerator improvements to meet existing and future stakeholder needs;
 - R&D efforts currently underway or planned.
- Broad attendance from stakeholders in medicine, industry, security (including energy and defense), and science



2 1/2 Days of the Workshop

❖ Monday 05/11:

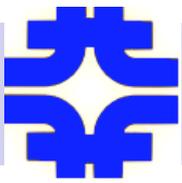
- ▲ reception
- ▲ overview talks by **M.Tigner** and **M.Church**

❖ Tuesday 05/12

- ▲ AARD: other facilities , possibilities for NML
- ▲ AM conveners: **P.Piot**, **M.Church**
- ▲ PM conveners: **K.J.Kim**, **S.Nagaitsev**
- ▲ Workshop dinner

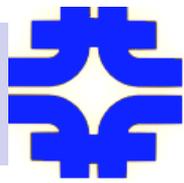
❖ Wednesday 05/13:

- ▲ High Intensity R&D: **M.Tigner**, **P.Spentzouris**
- ▲ ADS and Medical : **S.Schriber**, **W.Chou**
- ▲ summaries of 3 sessions: **conveners (X,Y,Z – TBD)**



Charge to the Workshop

- ❖ solicit and evaluate ideas that could be incorporated into a possible accelerator R&D program based on the ILC Test Accelerator in the New Muon Lab (NML) at Fermilab, which is currently under construction (including ideas for improving and refining the current NML design to further enhance its R&D potential)
- ❖ solicit and evaluate advanced accelerator R&D proposals specific to enhancing the potential of ongoing and planned Fermilab R&D efforts, including Project X, ILC, and Muon Collider (with emphasis on efforts that are synergistic between these programs and/or utilize currently existing or planned facilities)
- ❖ solicit and evaluate ideas for future accelerator applications of great potential but not yet part of the current Fermilab planned program such as medical accelerators and accelerator driven systems (ADS), including those based on the currently envisioned Project X facility.



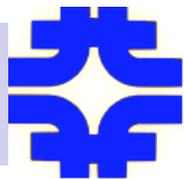
Outcome of the Workshop

❖ Better understanding :

- ▲ Fermilab people to understand broader picture
- ▲ Collaborators – possibilities at Fermilab

❖ Written report (conveners and OC)

- ▲ to FNAL management, in 6 weeks (by June 22), be presented at the FNAL DoE S&T Review (early July)
- ▲ will review the motivation, relevance, and uniqueness of each R&D component.
- ▲ used as the basis for a substantive R&D proposal for NML and the basis for further augmentation of the Fermilab accelerator R&D program
- ▲ input for future collaborative agreements/proposals



So :

Welcome to Workshop

Thank You For Coming!

Speakers, Conveners, Participants

We look for “brainstorming”

Any Ideas Welcome

Conveners will do extra work

Summarize presentations and discussions

To help them, please conclude your talks with:

“Therefore, I(We) Suggest: a) ... b) ... c)...”